AGRICULTURAL NOTES

PUBLISHED BY

PORTO RICO AGRICULTURAL EXPERIMENT STATION, MAYAGUEZ
OFFICE OF FARM MANAGEMENT, FEDERAL BUILDING, SAN JUAN

No.60, Page 1. Mayaguez, Puerto Rico, August, 1932.

THE EXPERIMENT STATION AND THE FRUIT GROWERS.

From September 1916 to July 1932 the Porto Rico Agricultural Experiment Station with headquarters at Mayaguez maintained an office in San Juan for investigation of the problems encountered by the fruit growers and for assisting the growers in the practical application of the results obtained.

As one of the measures of retrenchment in expenditures of the Federal Government, the Department of Agriculture ruled against granting further time extensions to those of its workers who had reached the retirement age, which is much lower in the Tropics than in the North. Under this ruling, Mr. Henry C. Henricksen was retired from the employ of the Federal Department of Agriculture. The fruit growers, however, not wishing to lose Mr. Henricksen's services, decided to themselves employ him.

The officials of the Federal Department of Agriculture were very much pleased that Mr. Henricksen's work could be continued, and the Department gladly cooperates with him in it by furnishing laboratory facilities and defraying a large part of the expenses involved.

T. B. McClelland,
Director.

SOME CITRUS PROBLEMS.

ABSORPTION AND MOVEMENT OF PLANT NUTRIENTS.

By Henry C. Henricksen.
Published in cooperation with the Fruit Growers Research Laboratory.

FEEDING ROOTS. - In the two foregoing articles of this series, Agricultural Notes, Nos. 56 and 57, roots were referred to as feeding or anchor roots, without a definite understanding of the difference between the two. Citrus trees are often encountered at roadsides and in odd places where there is very little chance for fibrous root formation, yet such trees keep alive and often they produce an abundant crop of fruit. This indicates that the trees are capable of supplying their nutritional needs by means of roots that are past the so-called fibrous stage.

An experiment was conducted for the purpose of gaining more light on this subject. The soil was excavated and washed away from sections of large roots that were devoid of fibrous roots. Sheets of paraffined paper were placed underneath the exposed sections in such manner as to prevent leaching or other-

wise spreading of salts applied. The exposed root sections were then covered with soil to which a small amount of lithium nitrate had been added. Lithium is a chemical belonging to the potassium and sodium group, and may be expected to enter a root and to move in a plant in a manner similar to that in which those elements do. It is suitable for determining the movement of elements in plants because ordinarily a plant contains no appreciable amount of lithium and mere traces of it can be detected spectroscopically. In this case it was definitely proved that lithium does enter through the bark of large roots devoid of fibrous roots, for it was found in the leaves of the trees of which the roots were treated as stated above.

That lithium behaves in the manner stated is a strong indication that other elements behave likewise and if so it proves that a tree is not entirely dependent upon its fibrous roots for supplying its nutritional needs. It does not show the extent to which that need is supplied. Possibly further work along that line may show absorption by large roots to be of no great commercial importance. On the other hand absorption through epidermal tissue may prove to be of great importance. The extent to which it takes place is well illustrated in the application of various salts by spraying leaves and branches with iron, copper, arsenic and other elements. That lithium does enter through the epidermal layers of leaves and branches was proved in connection with this work by spraying with a lithium nitrate solution, stripping off the epidermis and examining the underlying tissue.

MOVEMENT OF PLANT NUTRIENTS IN THE TREE. - It is well understood that fertilizer salts enter the roots in solution. Therefore a fertilizer is of no value without an adequate supply of soil moisture. But with an adequate supply the question naturally arise: How long a time does it require for the fertilizer salts to reach the leaves? This question was answered in the following manner: Lithium nitrate was applied to root areas at measured distances from the tree trunk, and leaf tissue from many different branches was examined spectroscopically at 6 to 12 hours intervals or oftener. The results showed that lithium did not move at the same rate as water. The six weeks drought during the months of February and March 1932 produced a dormancy of the trees so great that the leaves were very much withered. After irrigation water was applied a distinct change was visible in the leaves in 10 hours or less, but those leaves did not contain lithium until 36 to 48 hours later. The average movement of lithium was found to be through 12 to 13 feet of root, trunk and branch combined, in 48 hours. In all cases lithium was found in leaves and branches 25 to 30 feet from point of application 72 hours after the application was made. This indicates that with a

sufficient amount of soil moisture a large tree may begin to take advantage of the plant nutrients in a fertilizer about 48 to 72 hours after the application is made. It must be noted, however, that nutrients move straight upwards rather than around the tree. In this experiment lithium was found in the branches located above the roots to which lithium salts had been applied, but branches located on the opposite side of the tree contained no lithium, showing that fertilizers applied on one side of a tree cannot be expected to produce fruit on branches located on the opposite side.

The relative time of absorption by roots and movement in branches was not determined in citrus trees, but results from simultaneous experiments with sugar cane indicate that more time is required for absorption than movement. The average from several tests showed that a period of about 12 hours was required for absorption and movement of lithium into the stalk, a distance of 6 to 12 inches, whereas the movement in the stalk was at the rate of 1 to 2 feet per hour.

With the knowledge that fertilizer elements may be expected to reach the top of a large citrus tree about 72 hours after fertilizing the question arises, how long will it take the elements to be metabolized? Undoubtedly that varies according to the vegetative condition of the tree, but the question was satisfactorily answered in this case by observation of the drought-dormant trees mentioned above. On these new leaves were formed and bloom buds were expanded 5 to 7 days after irrigation water was applied. That, however, was the result of the water rather than the fertilizer, but the fertilizer showed its effect in the amount of bloom shed. The trees that were fertilized shed less bloom than the unfertilized. It is evident that, in this case at least, the nutrient elements were being metabolized shortly after entering the leaves for the results were visible after a few days. In other words the effect of the fertilizer was shown within 10 days after its application.